Basic Volcanic Terms and Explanations

Volcano: A volcano is a vent in the earth's crust from which molten (or partially liquid) rock or steam issues. The term volcano is also popularly applied to the volcanic structure (hill or mountain) which is usually built from the material ejected from such a vent. While in the earth's crust, molten rock is known as magma. Once it issues from the vent, both the liquid material and the solid rock it forms are known as lava.

Magma: is found in pockets within the earth's crust. These are known as magma chambers. The formation of these magma chambers is probably the result of several factors. Temperatures increase with depth so that 40 miles below the earth's surface temperatures may reach 2200°F. One might expect these rocks to be liquid, but because of the great pressure which exists at this depth, they are solid or semi-solid. When a reduction in the pressure such as associated with a buckling of the earth's crust occurs, then these rocks can liquefy. Liquefaction may also be brought about by increased heat, possibly due to friction along faults or by pockets of radio activity in the crust. The depths of magma chambers vary from a few to twenty or more miles. Once they form, magma tends to rise or be forced to the surface through cracks or fissures. The magma chamber then becomes known as a feeding chamber.

Materials ejected from a volcano vary because as magma cools its components separate. The first materials to crystallize are relatively poor in silica oxides and rich in iron, calcium and magnesium. These sink to the bottom of the chamber, leaving lighter materials which are relatively richer in silica oxides on top.

A major effect of crystallization within the chamber is a concentration of gas within the remaining liquid. Ultimately, the gas pressure becomes too great for the reservoir roof to withstand and eruptions begin. Initial eruptions reduce the pressure, allowing more gas to separate from the liquid. Thus the eruptions become self-sustaining and gas is their driving force.

The principal gas is steam (H2O) which can comprise as much as 95% of the discharge. Second is carbon dioxide (CO2), and third is sulfuric acid (H2SO4) – the gas that gives volcanoes their characteristic color. Gases released in minor amounts include hydrogen, ammonium chloride, carbon monoxide, nitrogen, chlorine and fluorine.

Eruptions may occur at any stage in the cooling and separating process and fissures may tap any level of the feeding chamber, resulting in a variety of lavas and volcanic products and formations. Lavas are primarily classified according to their silicon dioxide content, although the presence of other chemicals, texture, percentage and size of gas cavities, amount of crystallization and size of crystals are also important.

Because silicon dioxide acts as an acid, lavas with silicon dioxide content exceeding 66% by weight are known as silicic lavas. Two of these are found in Lassen Volcanic National Park. Rhyolite has a silicon dioxide content of about 75%, while that of dacite is about 70%. These white to grayish or pinkish lavas are stiff and viscous even at high temperatures and thus permit gas to escape with difficulty often resulting in explosive types of eruptions.

Basalts: have a silicon dioxide content of less than 52% and are termed mafic. They are dark colored and flow readily, allowing gas to escape with ease. Andesites are intermediate in characteristics between the acid and basic lavas. These lava types react with other factors to build volcanic formations including:

Basalt plateaus: Magma, under low pressure, may erupt forming swarms of fissures, to spread as floods of basaltic lava. The Northwest's Columbian Basalt Plateau is North America's finest example.

Shield Cones: Copious swellings of more viscous lava construct volcanoes which in profile resemble low domes or inverted saucers. Examples are Prospect Peak, Mount Harkness and Red Mountain.

Cinder Cones: Magma, under high pressure, will erupt explosively to form steep-sided volcanoes. Usually they are symmetrical in shape and are formed rapidly. Mexico's Paricutin, for example, grew 1,000 feet by the end of the second month. Generally, cinder cones are less than 1,000 feet high. Examples include Red Cinder Cone, Hat Mountain, and Cinder Cone.

Composite Cones: These are formed of alternate layers of lava flows from effusive eruptions and fragmental material from explosive eruptions. When exposed, a banding effect is evident. Examples include the high peaks of the Cascade Range: Mount Rainier, Mount Hood, Mount Shasta and ancient Mount Tehama.

Plug Domes: Extremely viscous masses of lava emerge rapidly and "en masse" from a vent to form a steep-sided, bulbous mound. These may vary from tens to thousands of feet in height. Lassen Peak is considered one of the world's largest plug dome volcanoes. Others are Chaos Crags, and Reading Peak.

The fragmented materials that fall from the eruptive clouds of volcanoes are known as pyroclastic products or tephra and are named according to their size, texture and composition. Material between pea and walnut size is called lapilli. Sand-sized material is called cinders. Smaller yet are ash and dust, although frequently no distinction is made between these two. Cinders, ash and dust may become compacted and recemented to form volcanic tuff. Material larger than lapilli which was not molten when ejected is known as block. When it is recemented with other angular rocks, it forms a rock known as breccia.

If the material was still molten when ejected so that it formed a rounded or spindle-shaped object while solidifying in the air, it is known as a bomb. If its surface is cracked so that it reminds one of the crust of a loaf of French bread, it is known as a bread-crust bomb. Bombs compacted into rock with other large round ejecta form agglomerates.

Highly vesicular, frothy, light-colored ejecta, with density often low enough to float on water, is termed pumice. Pumice is generally siliceous and acidic in composition. Highly vesicular, frothy, dark-colored ejecta, which is less siliceous, more mafic and more dense than pumice is termed scoria.

A lava flow which appears rough and blocky is called Aa (ah-ah), while a smooth, ropey or cordlike looking flow is known as pahoehoe (pa-hoy-hoy). Whenever lava flows into water and cools rapidly, it forms balls or spheres up to several feet in diameter and is known as pillow lava. Sometimes fluid lavas form lava tubes as they cool. These interesting caves are formed when the outer surface of a flow cools and hardens while the interior is still fluid. The interior lavas then continue to drain out the end of the flow, leaving a hollow tube behind.

Sometimes a lava flow is so viscous (characteristic of acid lavas) that it cools before it had a chance to crystallize. Then volcanic glass or obsidian is formed.

A bowl-shaped depression or crater is usually associated with the vent of a volcano as a result of the force of explosions. These rarely exceed three-quarters to one mile in diameter. Sometimes as a result of the draining of magma chambers, support is removed from the roof of a volcano and it may collapse on itself. Or perhaps a particularly violent eruption may blow the top away. In either instance, a caldera or depression much larger than the crater is formed. Calderas usually have steep sides and may have diameters of five to ten miles.

Some of the types of eruptions associated with volcanic activity are:

Icelandic: Lavas escape from fissures, rather than central vents. More copious flows produce no volcanoes, but rather large, level plateaus such as the Columbian Plateau.

Hawaiian: Typified by fluid basaltic lavas in which gases are liberated quietly. Thus little or no fragmental material is produced although fountains of lava may be projected by jets of escaping gas to heights of 1000 feet or more. Abundant outpourings produce flat lava domes forming some of the largest mountains on earth, such as Mauna Loa.

Strombolian: Named after a volcano off the coast of Sicily, these eruptions tend to be of moderate intensity and occur at more or less regular intervals. Eruptions are accompanied white vapor clouds and throw out glowing clots of magma (scoria) which cool to form bombs and lapilli. These eruptions occur with more viscous basalt and mafic andesite lavas.

Vulcanian: Although named after Vucano, Italy, Vesuvius provides better examples of this type of eruption. Here, the crater crusts over solidly between infrequent eruptions. Then strong eruptions, sometimes sufficient to disrupt the cone, occur blowing out of the obstruction. Pinos or huge cauliflower-like clouds of steam charged with fine particles are often formed. Lava may issue from the crater or fissures on the sides of the cone.

Pelean: The extreme in explosiveness, it is named after Mt. Pelee on the Island of Martinique, West Indies, where such an eruption in 1902 destroyed the city of St. Pierre and took 30,000 lives. Its distinguishing feature is the pyroclastic flow or glowing avalanche which contains superheated gas that is so full of glowing ash and other particles it obeys the force of gravity, rushing down the slopes of mountains with hurricane force Several have occurred in the Lassen region.